

(No Model.)

2 Sheets—Sheet 1.

J. LISTER.  
BOILER FURNACE.

No. 528,958.

Patented Nov. 13, 1894.

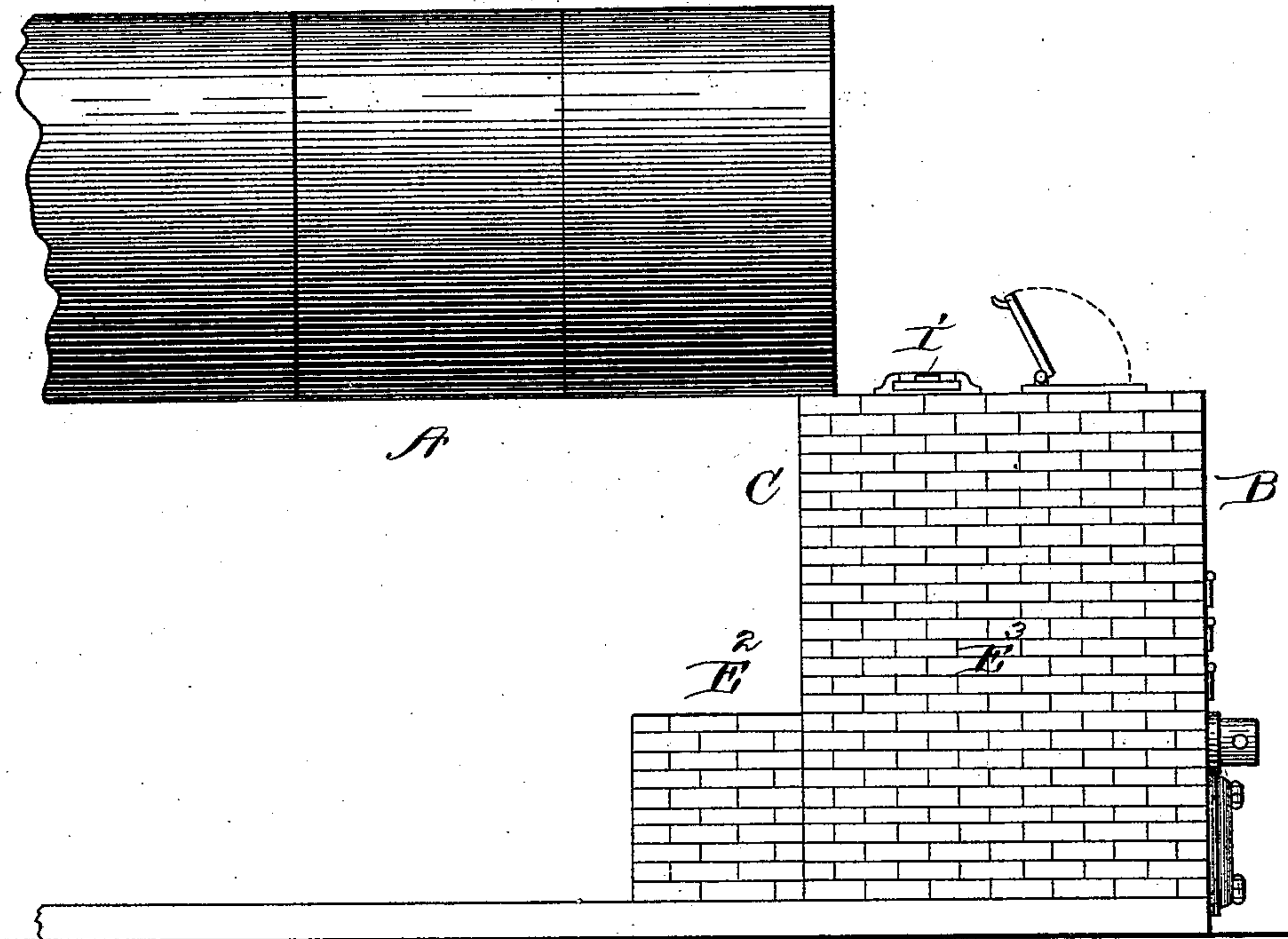


Fig. 1.

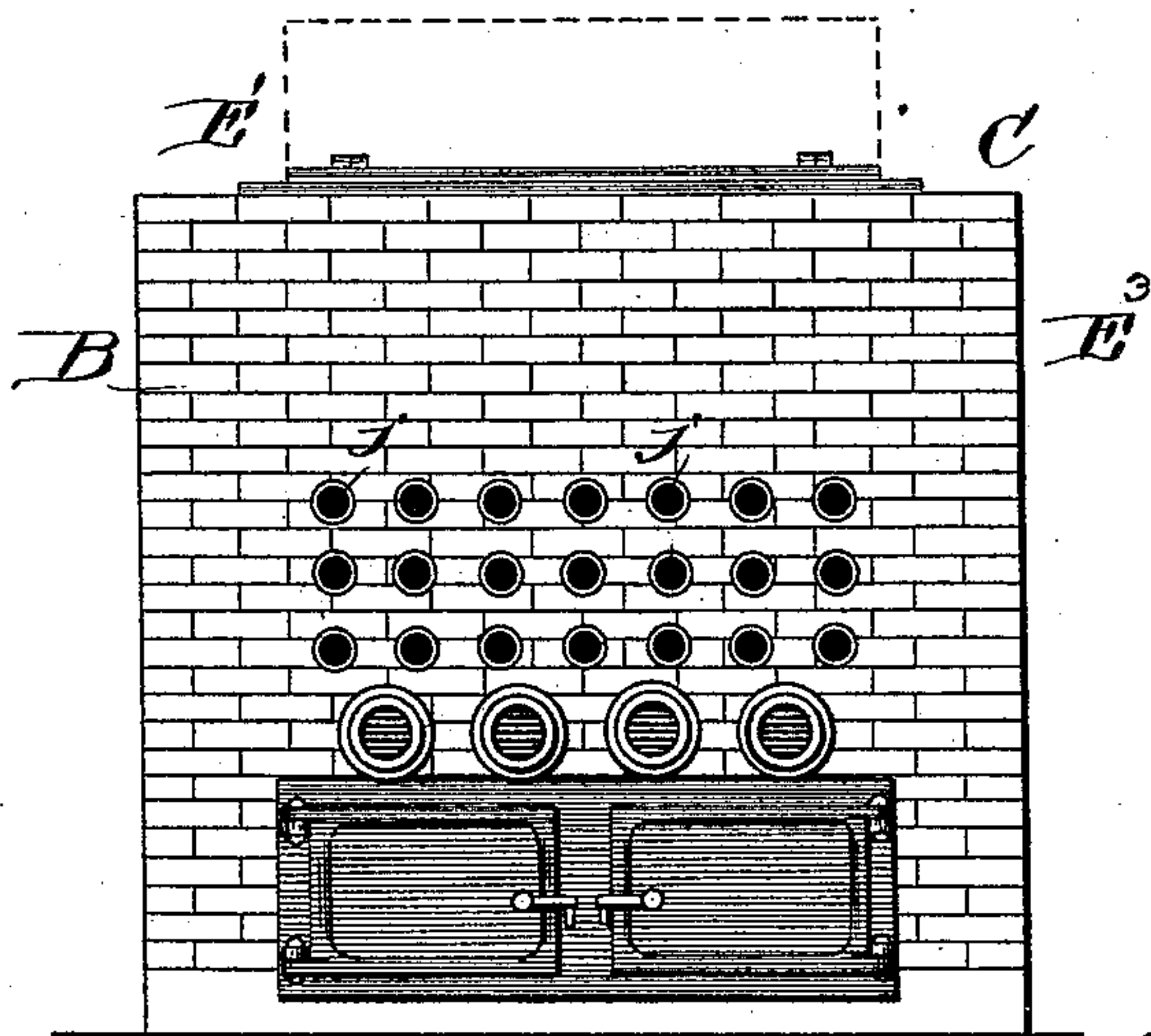


Fig. 2.

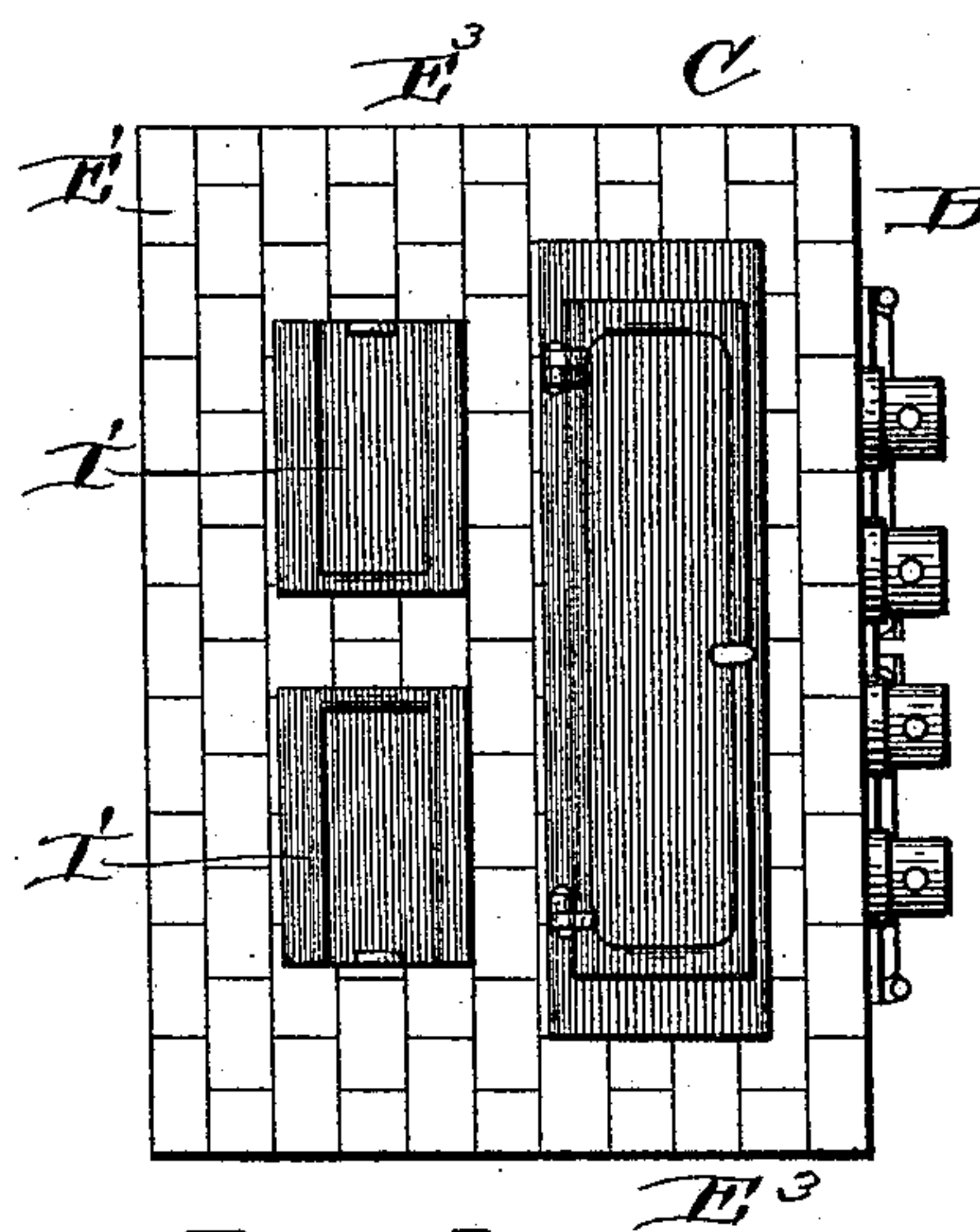


Fig. 3.

WITNESSES:

Fred W. Hersey.

Chas. H. LaPorte.

INVENTOR:

Joseph Lister

by A. S. Bliss

his Atty.

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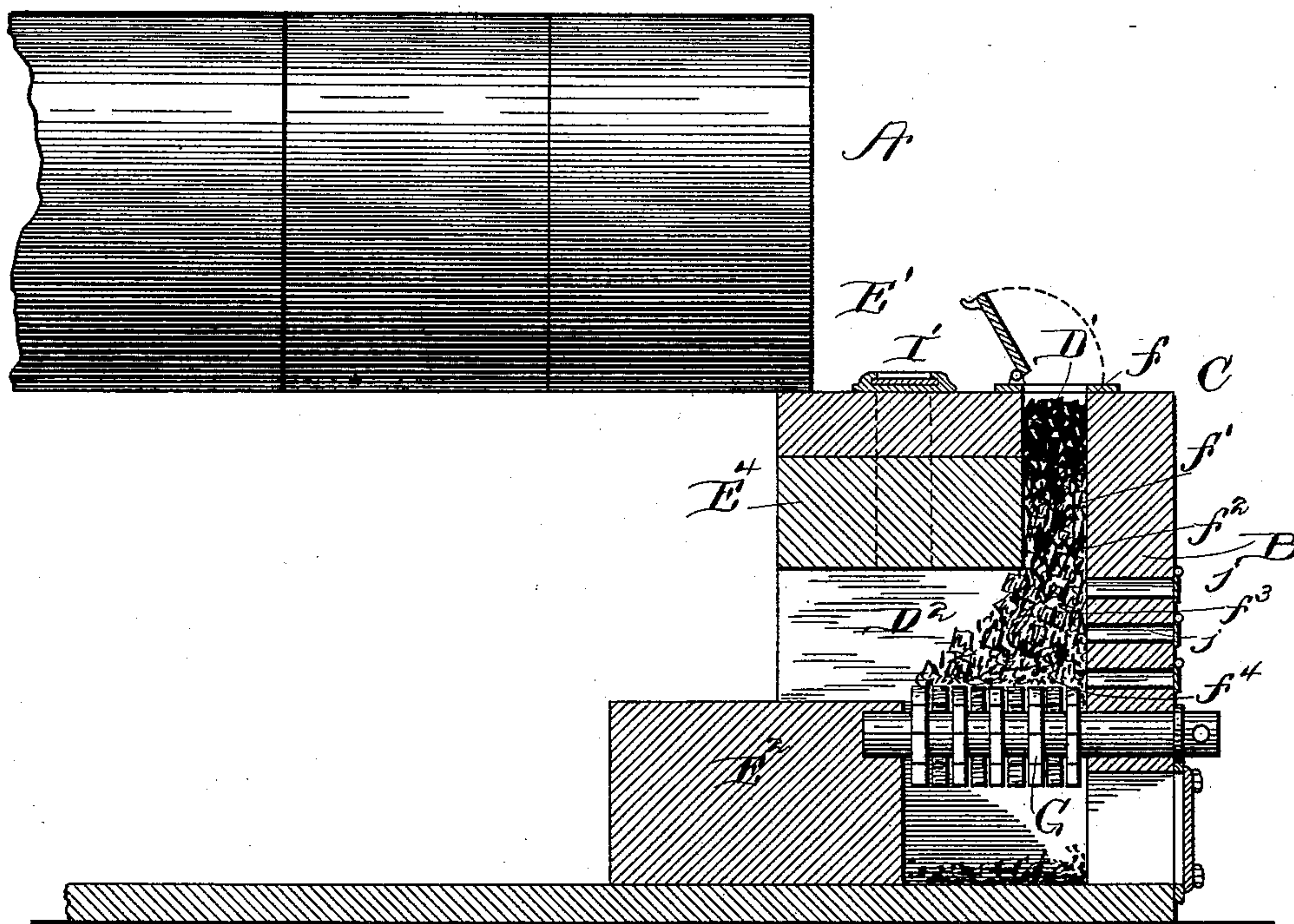


Fig. 4.

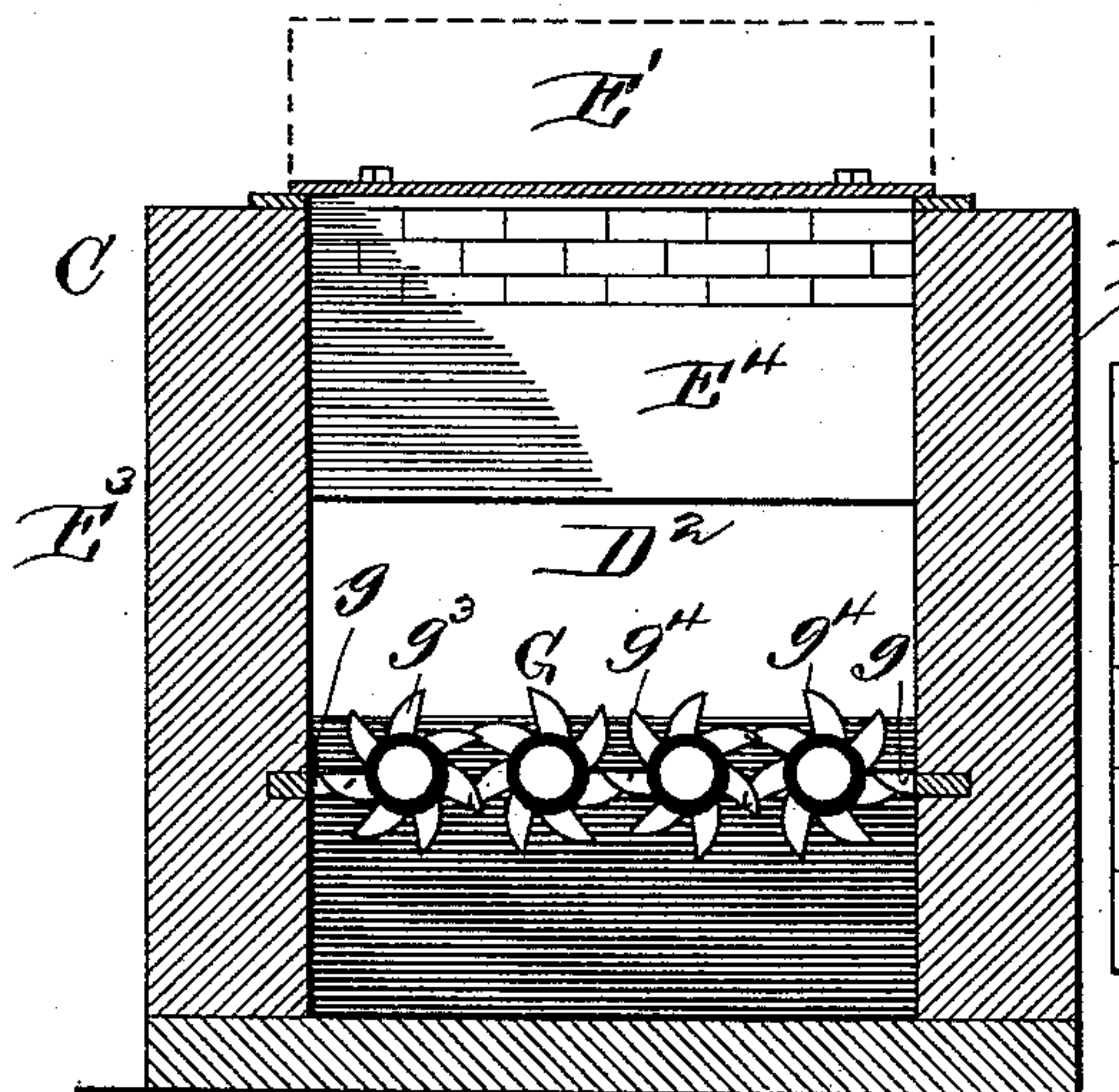


Fig. 5.

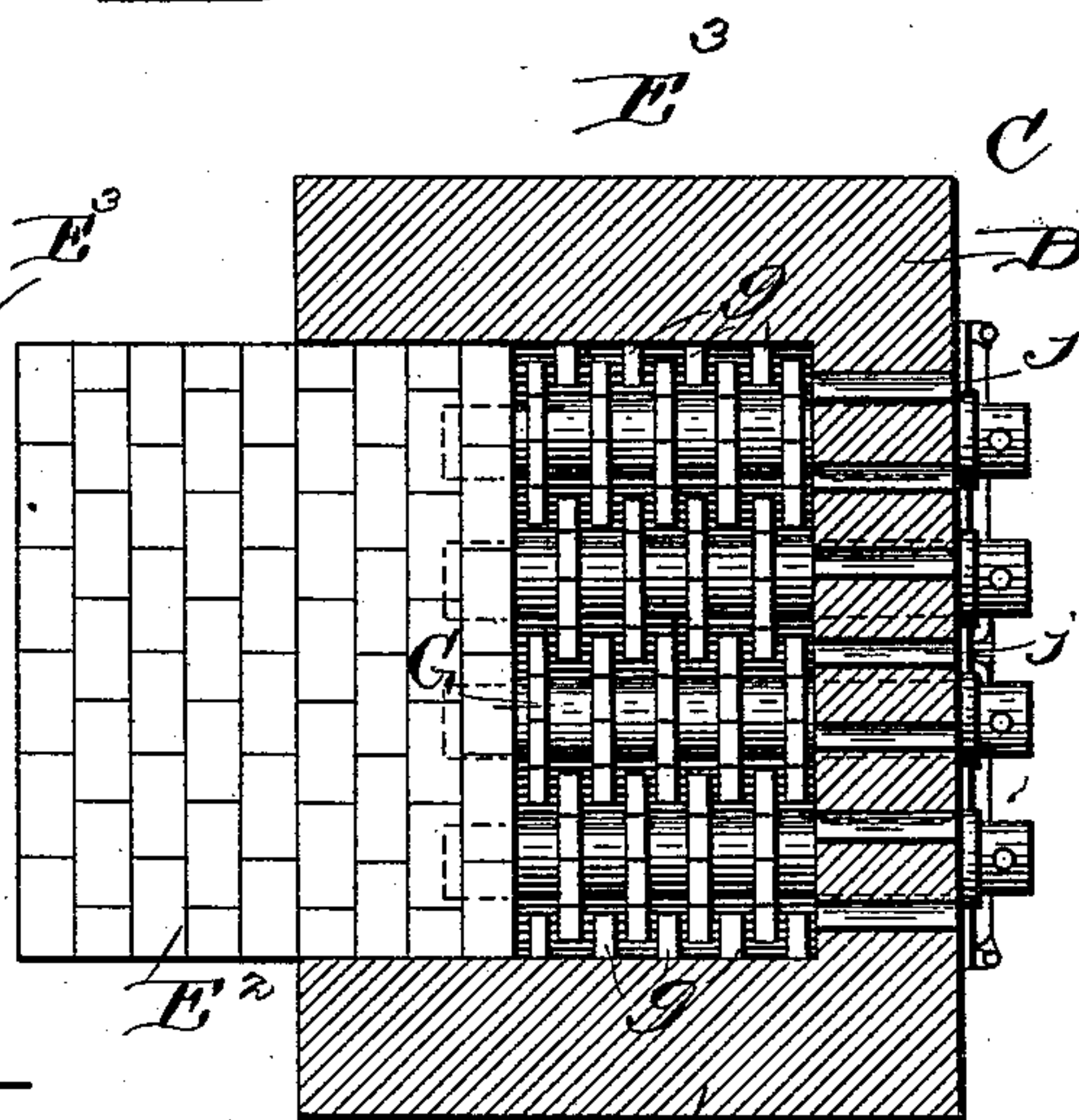


Fig. 6.

WITNESSES:

Fred W. Hersey.

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INVENTOR:

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# UNITED STATES PATENT OFFICE.

JOSEPH LISTER, OF CHICAGO, ILLINOIS.

## BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 528,958, dated November 13, 1894.

Application filed May 19, 1894. Serial No. 511,788. (No model.)

*To all whom it may concern:*

Be it known that I, JOSEPH LISTER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Boiler-Furnaces; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in furnaces, pertaining more particularly to constructions of the sort used in connection with steam boilers and in which soft or bituminous coal is used as fuel; and it pertains more particularly to improvements upon the construction shown in my earlier patent, No. 511,536, dated December 26, 1893.

In the drawings, Figure 1 is a side elevation of a furnace embodying my improvements, showing also a part of the boiler. Fig. 2 is a front view of the furnace. Fig. 3 is a top plan view. Fig. 4 is a vertical longitudinal section. Fig. 5 is a vertical transverse section. Fig. 6 is a horizontal section.

In the drawings, A indicates a portion of a steam boiler sufficient to illustrate its relations to the furnace and fire chamber, the furnace being indicated by C and the combustion chamber by D<sup>2</sup>.

The furnace is constructed of any dimensions desired, and reference may be made to my said earlier patent for the details of construction. It is built up almost entirely of refractory material, having a front wall B, a top B', side walls E<sup>3</sup>, and a lower wall or hearth portion E<sup>2</sup>.

E<sup>4</sup> represents the arch, which, I do not make curvilinear in section, but in such way that it has a flat or horizontal surface at the bottom. The fuel is introduced into the vertical feeding flue D' which extends down into the fuel chamber and also acts for the duct for the draft.

The combustion chamber is indicated at D<sup>2</sup>, there being additional air ports *j* formed in the front wall to supplement the draft of air

taken through tube D' and which are left open, when it is desired to start the fire.

I' are doors or dampers back of the fuel flue D', and which regulate the air to be admitted to the combustion chamber and which also modify the temperature of the top wall E' and the arch E<sup>4</sup> so as to prevent their being burned.

The grate bars G, G, are peculiarly constructed for a purpose to be described. They are journaled in the front wall of the furnace and also in the back or hearth portions E<sup>2</sup>. Each is formed with a number of arms *g*<sup>3</sup> preferably having the conformation shown, that is to say, each having an operative edge *g*<sup>4</sup> which is radial in relation to the grate bar and having a curved back edge which is more nearly tangential. The front end portions of these bars G project beyond the front walls and are provided with sockets or apertures for the application of a bar or wrench to rotate them. Such rotation results in the crushing or grinding of the cinders which accumulate at the bottom of the fuel chamber.

*g, g,* indicate toothed plates which are seated in the side walls, the teeth being arranged relatively to the projections on the grate bars.

When the furnace is charged with coal, the conditions of the various parts of it vary and the localities of these differing parts are more or less well defined. Thus at *f* the coal is in a state substantially similar to that in which it was introduced. That at *f'* somewhat lower down has commenced to be effected by the heat and to have the gaseous elements released and drawn downward in the combustion chamber. The material at *f*<sup>2</sup> has been reduced to coke. At *f*<sup>3</sup> the coke portions have reached the highest temperature at the time the last carbon ingredients are being burned. At *f*<sup>4</sup> the ashes and the cinders, which are formed by the great heat, accumulate, and they act to form a jacket or non-connecting protector for the grate bars so that the latter are never raised to a dangerously high temperature.

In my said earlier patent, the grate bars G, G, are two in number and are arranged transversely of the combustion chamber; and I have found by experience that the coal



has always commingled with it much foreign matter which being melted by the intense heat forms such hard clinkers that it has been difficult to rotate the grate bars. In my said  
5 earlier construction, they must of course be of comparatively great length and although they are protected by the jacket of cinders and ashes, yet at the same time they are liable on account of their length to be bent  
10 and warped by the weight resting upon them. Therefore, in order to obviate these difficulties and to prevent such warping and bending and in order to render it much easier for the attendant to rotate these bars for the  
15 crushing of the cinders I have as aforesaid arranged the bars longitudinally of the furnace, they being now four in number and of relatively much shorter length and more capable of withstanding the weight and of being  
20 rotated. In order to support them properly, I form large bearings for them in the hearth  $E^2$  which latter part of the structure is also materially modified in comparison with that in my earlier furnace. It is carried in  
25 to a line considerably beyond the wall of the arch  $E^4$ , and well under the front end of the boiler; the result being that the currents of combustion products are immediately deflected upward away from the region of the

grate bars and against the under side of the 30 front end of the boiler, and do not tend, as in the earlier construction, to flow along the bottom or floor of the fire chamber under the boiler.

What I claim is—

In a down draft smoke consuming furnace, the combination of the inner arch  $E^4$  supporting the boiler, the outer or front wall B, the relatively narrow vertical fuel duct between the front wall B and the arch and communicating with the longitudinal combustion 40 chamber  $D^2$  beneath the arch, the relatively short rotary grate bars situated longitudinally of the boiler and having their outer ends mounted in and projecting through the 45 front wall B, and the hearth  $E^2$  formed with bearing apertures for the inner ends of the short grate bars, said hearth  $E^2$  extending beyond the inner face of the arch and lying directly below the boiler, substantially as set 50 forth.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH LISTER.

Witnesses:

THOMAS HEARING,  
J. L. MCKITTRICK.